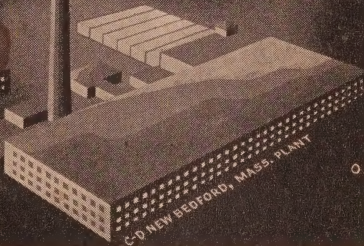
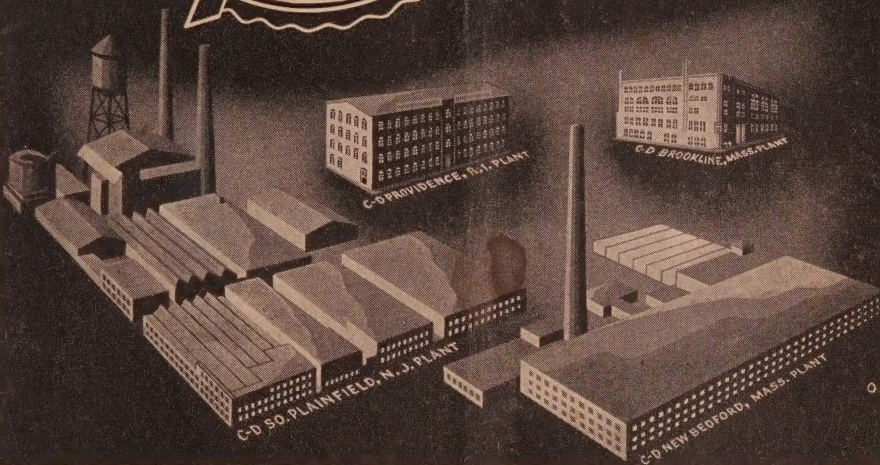


The CORNELL-DUBILIER Capacitor



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No. 6

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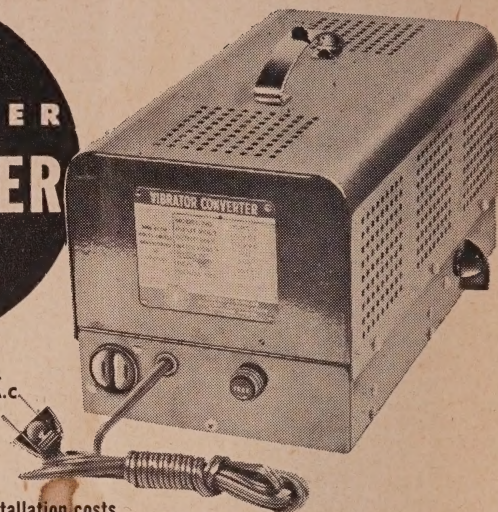
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VOLTAGE-REGULATED POWER SUPPLIES

Stabilized operation and constant calibration of all types of electronic equipment require that fluctuations in the operating voltages and currents supplied to such equipment be held to a minimum. The frequency of a self-excited oscillator, for example, will shift quite a few hundred parts per million, depending upon frequency, when the plate voltage of the oscillator tube is changed slightly. Output power and impedance of an amplifier likewise follow changes in plate voltage.

Voltage-regulated power supplies have been developed to deliver a practically constant output voltage although the input voltage to the unit or the output current drawn from the unit fluctuate considerably. Current regulators also are available for those applications in which current values must be held constant although the load voltage fluctuates.

This article describes circuits and devices for voltage and current regulation. It has been our aim to include enough practical data in this discussion to enable the reader to construct automatically-regulated power supplies either for external use or to be built into other electronic equipment.

Gaseous-Tube Voltage Regulators

The simplest voltage regulating device lending itself to inclusion readily into any d. c. power supply is the gaseous regulator tube, also known as a glow tube. These tubes currently are manufactured in the following types: OA2, OA3/VR75, OC3/VR105, OD3/VR150, and 874. Also obtainable is the VR90-30 (also called OB3) which still is on the market but has been dropped from some manufacturer's lists. The OA3 supplies 75 volts

of regulated d. c.; the VR90 and 874, 90 volts; OC3, 105 volts; and the OA2 and OD3, 150 volts. Used intelligently, these tubes (or combinations of them) afford a simple means of obtaining reasonably constant d. c. potentials from conventional rectifier-filter systems.

The gaseous regulator tube operates on the principle that a constant voltage drop appears across the tube regardless of the current flowing through it, once the ignition potential of the gas has been reached. The maximum current which may be passed through each of the regulator tubes except types 874 and OA2 is 40 milliamperes. Maximum current rating of the 874 is 50 ma., and for the OA2, 30 ma. At all times, the current from the filter output of the power supply is divided between the regulator tube and the output (load) circuit. As more current is drawn by the load, less current flows through the tube. A minimum current of 5 ma. must flow through the tube at all times (10 ma. for the 874), otherwise the gas discharge will be extinguished and regulation will be lost.

All gaseous regulator tubes will hold the d. c. output voltage constant within a few volts. The following control figures are given by the tube manufacturers: OA2, 2 volts; OA3, 5 volts; OC3, 2 volts; OD3, 4 volts; VR90, 8 volts; and 874, 7 volts. This means that the output with type OD3 will be 150 volts within 2 volts, the OA3 75 volts within 2 volts, etc., etc. When closer regulation than these values is required, some system of automatic voltage regulation other than gaseous tubes should be used.

Figures 1 and 2 show typical gaseous-tube voltage regulator circuits.

Figure 1 is the basic arrangement. R is a series resistor used to limit the current through the tube. The size of this resistor is very important to operation of the circuit. The ohmic value of R depends upon the maximum

0.04 ampere. From Equation (1), $R = (200 - 150)/0.04 = 50/0.04 = 1250$ ohms. The power which the resistor must dissipate is equal to $I^2R = 0.04^2(1250) = 0.0016(1250) = 2$ watts. For good safety factor, we

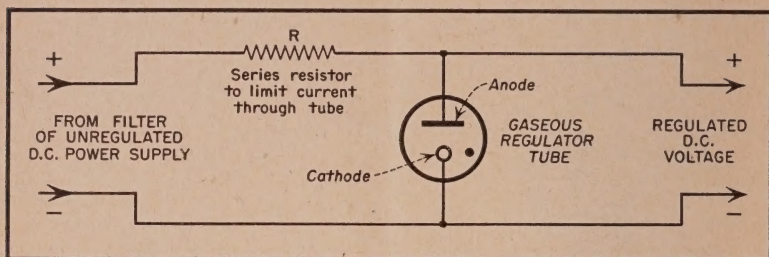


Fig. 1. Basic connection of gaseous regulator tube.

value of the d. c. input voltage, the maximum current rating of the regulator tube, and the expected maximum load current. The simplest way to determine its value in cases where the input voltage does not fluctuate greatly is by means of the following equation:

$$(1) \quad R = \frac{E_1 - E_2}{I}$$

Where R is the required resistance, in ohms

E_1 is the d. c. input voltage from the power supply filter

E_2 is the voltage rating of the gaseous regulator tube

I is the maximum current rating of the tube in amperes.

Consider a typical illustrative case in which 150 volts d. c. output regulated within 2 volts must be obtained from a 200-volt unregulated power supply. A type OD3 tube is selected, since the output voltage of this tube is 150 volts and its regulation control figure is 2 volts. The voltage rating (E_2) of this tube is 150; the maximum current rating of the tube is 40 milliamperes, or

would choose a 5-watt resistor. So R would be 1250 ohms, 5 watts.

When input-voltage fluctuations are large, it may be necessary to alter the resistance of R as determined by means of Equation (1), or it will be necessary to reduce the output load current. This is necessary because the voltage drop across a certain series resistor may be great enough to cause the tube to become extinguished when the input voltage falls to its minimum value. For instance, the starting voltage of the OD3 is 160 volts. A resistor which might satisfy the maximum input voltage conditions (that is, when the input voltage fluctuates to its highest value) will allow the glow to extinguish if the input voltage falls to 140. Thus, it is seen that the highest output current drains are possible only when fluctuations of the d. c. input voltage to the regulator tube are relatively small.

When higher output voltages than can be supplied by one gaseous regulator tube are required, several such tubes may be connected in series, as shown in Figure 2(A). Thus, two type OC3 tubes will regulate 210 volts (2 times 105 v.) and three type OB3's

will regulate 270 volts (3 times 90 v.), etc., etc. The current through the series string will be the same number of milliamperes as stated for one tube. However, when tubes having different current ratings (such as 30 ma. for one and 40 ma. for the other) are series-connected, the maximum current through the series string must not exceed that specified for the lowest-current tube. Taps may be taken between any two tubes (See Figure 2-A) in order to obtain intermediate voltages.

When higher output currents are required than one gaseous regulator tube can supply, several such tubes may be connected in parallel, as shown in Figure 2(B). However, a 100-ohm resistor (R_2 and R_3 in Figure 2-B) must be connected in series with each tube in order to divide the current equally between the tubes. Higher resistances must not be used, since even the relatively low 100-ohm value reduces the regulation efficiency somewhat.

present in the powered circuit directly across the regulated d. c. output, their total capacitance must not exceed 0.1 microfarad, otherwise oscillation will take place. The reason for this oscillation is clear from an examination of Figure 1. If a capacitor is placed across the regulated-d. c. output terminals, a conventional relaxation-type oscillator circuit is formed by the tube, the capacitor, and resistor R.

4-Tube Regulated D. C. Power Supply

Figure 3 shows the circuit diagram of a voltage-regulated d. c. power supply which delivers an output voltage stabilized within 1 volt. This degree of stabilization holds for input voltage variations or output current (load) variations up to about 30 per cent of the initial values. A unit of this type should be used whenever the severity of requirements precludes use of simple gaseous regulator tubes.

In this circuit, the 6B4-G tube acts as a variable resistor in the d. c. out-

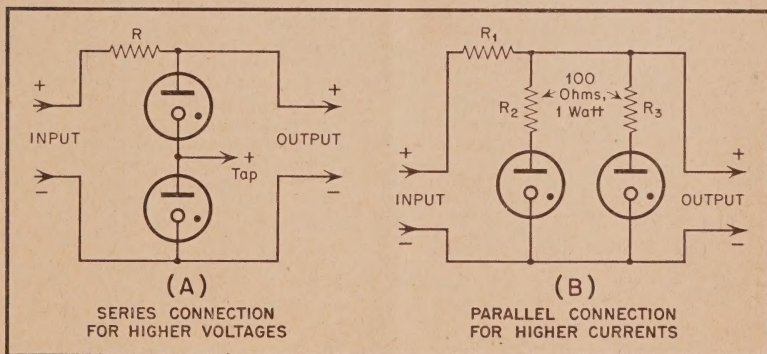


Fig. 2.

Oscillation is a common trouble experienced by many builders of gaseous-tube voltage regulators. This is caused by one or more capacitors in the load (output) circuit which the regulator supplies. When such capacitors are

put circuit of the filter. In this respect, it is an electronic rheostat. The plate resistance of the 6B4-G is controlled by the grid bias voltage of this tube which in turn is delivered by the 6SJ7 d. c. amplifier tube. If the d. c.

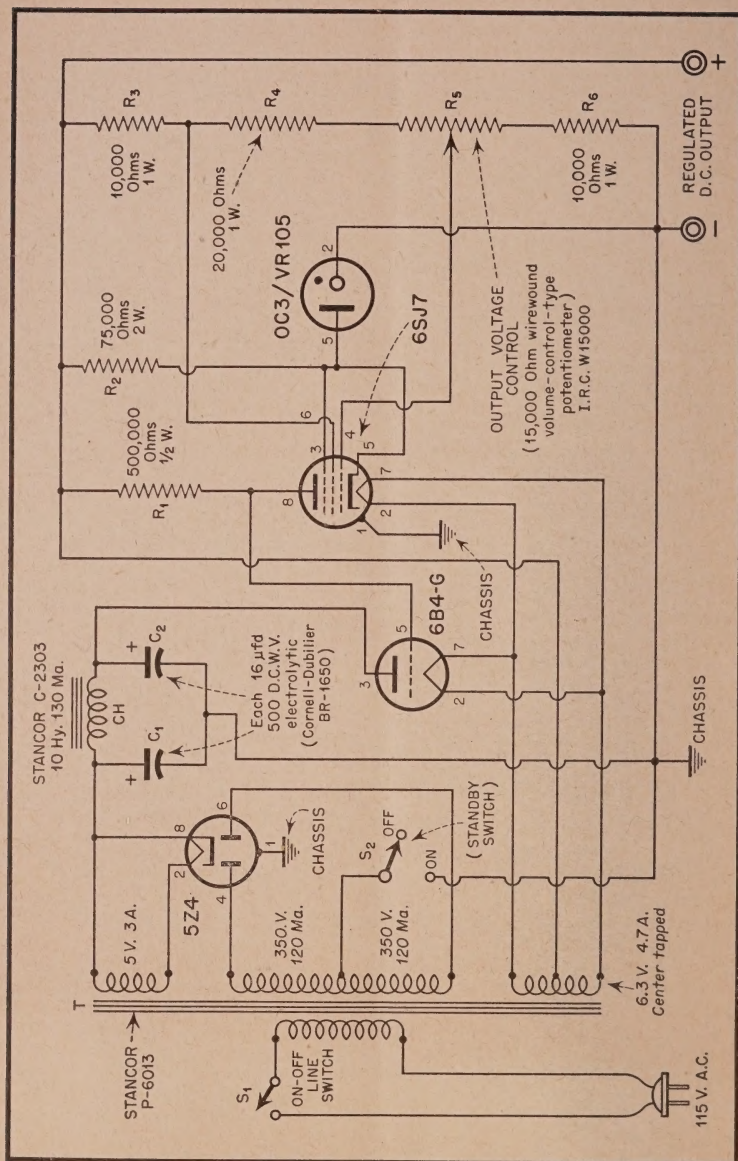


Fig. 3. Voltage-regulated d.c. power supply.

output of the entire system tends to fall in value, the bias on the 6B4-G will be decreased automatically. The plate resistance of the 6B4-G accordingly will decrease, permitting the output voltage to rise. Thus, any output voltage change bucks itself out.

The regulated output voltage may be set at any value between about 175 and 300 volts by means of the output-control potentiometer, R_s . At 300 volts, the current which may be taken from the output terminals with good regulation is approximately 60 milliamperes; at 175 volts, it is 110 ma.

Regulated power supplies having larger voltage and current output capabilities may be constructed along the same lines by employing a heavier-current rectifier tube than the 5Z4 and a larger control tube than the 6B4-G.

A. C. Voltage Regulation

Electronic circuits may be stabilized also by regulating the a. c. voltage input. In precision laboratory equipment where the highest order of stability is required, a. c. stabilization often is employed in addition to d. c. voltage regulation.

Perhaps the most satisfactory method of regulating a. c. voltage is to use one of the so-called regulator transformers. These units utilize the principle of core saturation and provide close regulation either of power-line voltage or of filament (heater) voltage. Regulator transformers are simple to use and may be built into the equipment which they supply. They are furnished for a wide variety of volt-ampere drain requirements. Although voltage regulator transformers normally are rather high-priced, several useful models of various volt-ampere capacities are obtainable currently at reasonable prices in the surplus market.

Two other methods for a. c. voltage regulation are shown in Figure 4.

The first scheme (See Figure 4-A) employs two gaseous regulator tubes connected in parallel back-to-back between the a. c. power line and the primary winding of the transformer to be regulated. The resistance of R is

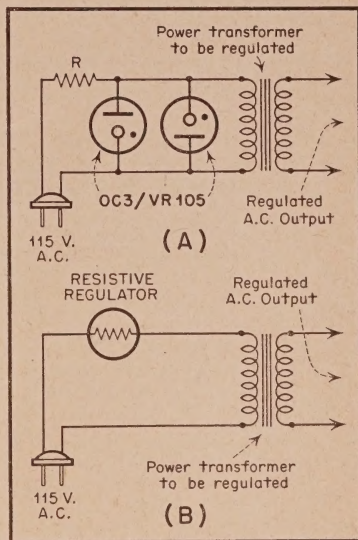


Fig. 4. Simple a. c. voltage regulators.

selected to have such a value as to limit the maximum current through both tubes to 80 milliamperes, while at the same time not being so high as to allow the tubes to deionize when the line voltage fluctuates to its minimum value.

The regulated voltage delivered to the primary of the transformer will, of course, be somewhat lower than the line voltage (being equal to the line voltage less the drop in resistance R). The transformer secondary turns must be increased therefore to give the same output as obtainable without the regulator, or the circuit it supplies must be modified to operate at a lower voltage.

This regulator can supply only a limited output current and accordingly is satisfactory only for light-drain instruments such as simple oscillators, v. t. voltmeters, etc.

The second type of a. c. voltage regulator, shown in Figure 4(B), utilizes a special resistance unit which

connected into the power supply circuit, as an electronic series resistor, may be employed as a current regulator. Such an arrangement is shown in Figure 5(A).

The screen voltage and control grid (bias) voltage of the tube are proportioned so that the tube is operated

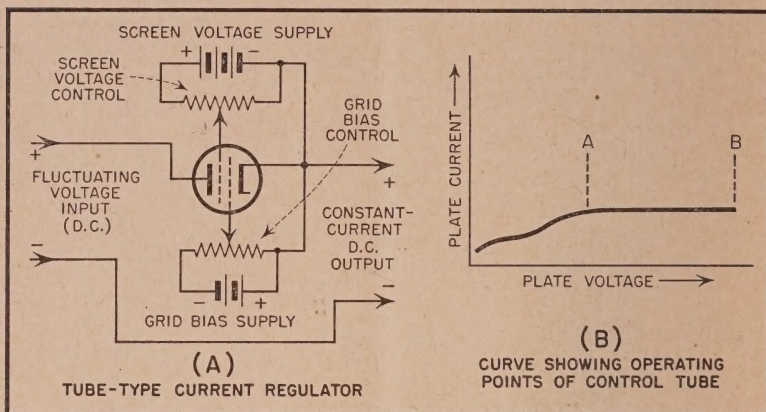


Fig. 5.

tends to iron-out voltage variations by maintaining a constant current through itself. These resistance units are known by various trade names, such as voltage regulators, voltage controls, and line ballasts. They are supplied in a variety of types to suit a wide range of power-drain requirements, and are obtainable as tube-type glass bulbs as manufactured by the Amperite Co. and as ventilated-metal-encased units as manufactured by the Clarostat, Wirt, Continental, Jackson, and other companies.

Simple Current Regulation

In some applications, d. c. voltage excursions can be tolerated but current must be held to a constant value. A pentode or beam tetrode tube, con-

along the nearly straight, horizontal portion of its E_p - I_p characteristic curve (this is the region between points A and B on the sample curve in Figure 5-B. From the curve, it will be noted that the current changes only slightly as the voltage fluctuates between the wide limits set by points A and B.

A type 6L6 tube connected in the circuit shown in Figure 5(A) and operated at 50 screen volts and 0 control grid volts shows virtually no current variation between 200 and 500 volts.

While batteries are shown in Figure 5(A), the grid and screen voltages can be obtained from separate a. c.-operated power supplies or from taps on a suitable voltage divider in the power supply which is being regulated.



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WANTED—Radio equipment catalogs 1900 to 1930 such as Electro-Importing, Wm. B. Duck, etc. Also, complete sets of early Radio News, Electrical Experimenter, Science and Invention, etc. John C. Batchelor, 52 Wall St., New York 5.

FOR SALE—Mark II tank transceiver, converted to 110V ac or 12V dc. A complete ham rig in one package, with wiring diagrams and service notes, \$75 FOB Seattle. R. M. Hilton, 4123 Bagley Ave., Seattle 3, Washington.

FOR SALE—New electric phonograph 3 tube amplifier, 12" disk, 6" speaker, volume control; copper vertical aerial, 12', 3 sections; 5 metal radio tubes. All for \$20, or sell separately. Herman Fischer, 48 Sixth Ave., Brooklyn, N. Y.

WANTED—A BC221 frequency meter in good shape. Walter Keith, 201 W. 2nd St., N. Newton, Iowa.

FOR SALE—Cine Master II, like new with f2.5 lens, in orig. box with extra spools, \$50 plus postage; electric cathedral desk clock, \$1; Watthour meter, 110V 10A, new, \$7; shielded RF ant. and det coil and 2-gang cond. for BC band, \$1.50. W. Chrusch, 152 Fifth St., Elizabeth 1, N. J.

FOR SALE—Meissner model 9-1040 12 tube Analyst, complete with headphones and manual, in good shape, \$45. Also complete 1947 National Schools radio course, without kits \$15, with kits, \$25. Gene's Radio Service, P.O. Box 5, Lake Placid, Florida.

FOR SALE—General Industries RM-4 recording motor, 78 rpm, and Shure Glider pick-up, mounted in open top case, excellent condition, no amplifier, connect to phone input, \$10 postpaid. Sidney Feldman, 45 Lott Ave., Brooklyn 12, N. Y.

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FOR SALE—Carbon and wire wound resistors; fuse holders, extraction type; Weston ac ammeter, mod. 156; Webster record changer, mod. 56. John Stine, 112 Glover St., Jersey Shore, Pa.

FOR SALE—Precision sig. gen., E-200, excellent condition. Also Precision 912P tube tester, perfect, instructions included. Interested in Signal Corps gen. BC-221 and the like, 110V 60 cycles only, state freq. coverage and price. Milton Zwerling, 3400 Menlo Dr. Baltimore 15, Md.

FOR SALE—Presto K8 recorder and PA system, used 8 hours, new condition, \$229. George Flaster, 3101 Brighton 2nd St., Brooklyn 24, N. Y.

SWAP—Over \$500 worth of toolmakers tools in 7 drawer Kennedy box, including micrometers, vernier, indicators, etc., not war products, write for detailed list. Want transmitter or TV set. Wallace Printz, 1259 East 13 St., Brooklyn 30, N. Y.

SWAP—NRI radio and television course complete, in very good condition. Want Aerovox model No. 76 condenser checker or similar make, or what have you? David Friedman, 1759 W. 7th St., Brooklyn 23, N. Y.

FOR SALE—Army Walkie Talkie, model BC-322, range 52 to 65mc, new condition, complete with handset battery pack and telescopic antenna, ready to use, \$55. J. R. Sidelko, 29 Main St., Luzerne, Pa.

TRADE—Leeds and Northrop wheatstone bridge, laboratory type; RCA model AVR 100A aircraft rec., with beacon and broadcast band coverage, new tubes, good operating condition, power 1½V "A" 67½V "B." Want used scope, test equip., Riders Manuals, or? Thomas A. Koslosky, 11235 Exeter Rd., Carleton, Mich.

WANTED—One Wunderlich tube, if possible, or information on rewiring. This is for a Stewart-Warner model No. R-104-A. State price. Grant LaMaye, 552 E. 8th, Erie, Pa.

FOR SALE—Philco sig. gen., model No. 024, good condition, complete with leads, \$15. Clinton Weddle, P.O. Box 265, Bassett, Va.

SELL OR TRADE—1948 NRI Servicing and Television course, Audels Radioman's Guide, Audels Mathematics and Calculations, and Riders' Test Instrument book. Will trade for good sig. tracer, or condenser tester. John Wheeler, 3224 Springhill Ave., Crichton Sta. Mobile, Ala.

FOR SALE—Precision 912 tube tester, Precision 856 dual-sensitivity VOM, and a Jackson 640 sig. gen. \$40 each or all three for \$110. Larry Klein, 141-28 70th Ave., Flushing, N. Y.

FOR SALE—Hickok tube tester and analyzer, A-1 condition, model No. 534P, used only 2 weeks, \$120. Also Masco Disc Recorder, good condition, \$80. W. E. Sawalida, 1210 E. 82 St., Cleveland 3, Ohio.

FOR SALE—Guaranteed new tubes. Will trade tubes. Send for list. Goodwin Radio Shop, Rankin, Illinois.

FOR SALE—Hallicrafters S40-A, 9 tubes, 4 bands, 540kc to 43mc, excellent condition, \$50. Richard M. Smith, 55 Park Pl., East Aurora, N. Y.

SALE OR TRADE—National N.C. 173 rec., excellent condition, less than one year old. Want National H.F.S. high freq. rec., or will take \$150. Charles Jordan, 959 Elmwood, Fort Worth, Texas.

FOR SALE—National HRO Junior rec., complete, in Parr Metal black crackle cabinet 28"x21"x15", 190kc to 30mc continuous, extra power supply and instruction manual, good condition, \$70. Frank L. Habich, 55 Hedges Avenue, Chatham, N. J.

FOR SALE—Instructograph code tape machine, with built in electric oscillator, key connectors, five tapes, good condition. \$15 cash, or will ship COD. Gilbert Watson, 1008 Sonsom Ave., Alabama City, Ala.

FOR SALE—Brush sound mirror BK-401, practically new, excellent condition, \$160. Diamond Power Specialty Corporation, Detroit, Michigan.

FOR SALE—Vomax model 900, with test leads and instruction manual, packed in original box, good condition, \$45. J. W. Bentley, 3003 Rose Ave., Columbus, Georgia.

FOR SALE—McMurdo Silver AM and FM sig. gen., model 906, used 4 months, perfect condition, \$90. Bernard Marsh, 207 S. Broad St., Nazareth, Pa.

WANTED AND TRADE—Trade New BC312 ac converted, crystal filter, S meter, radio receiver for ART 13 transmitter. Want technical manual or operating instructions for BC375E transmitter. J. P. Hyde, Manassas, Va.

FOR SALE—TS-1 Feiler sig. tracer, with vacuum tube probe and batteries, \$7. Also have assortment of carbon and wire wound resistors. Ralph G. Cummings, 170 Clark St., Portland, Me.

TRADE—Will trade a new 348-R receiver, converted to ac operation, for a good .22 caliber target pistol or a rifle suitable for hunting deer. John E. Kent, P.O. Box 460, Waynesboro, Virginia.

FOR SALE—BC-314, with mounting and RA-20 110 volt power supply installed, new, used only two hours, complete, \$69.50. Franklin W. Wiggin, 15 Concord St., Natick, Mass.

FOR SALE—Ghirardi Modern Radio Servicing and Radio Physics; also Maedel's Mathematics for Radio, vol. 1 and 2, perfect condition. All four books, \$10. D. Salandra, 639 E. 225 St., N. Y. 66, N. Y.

FOR SALE—Brush Soundmirror recorder, new in original carton, cost \$229.50, sell for \$190, including two 1/2 hour reels. Also Hammarlund HQ120X with speaker, used very little, \$65. N. P. Salomone, 108 Wilkinson Ave., Jersey City 5, N. J.

FOR SALE—Two 365 mmfd. 4 gang condensers. Also one 15" (1650 ohm field) dynamic speaker. Alton Ritter, 31 Rositer Ave., Paterson 2, N. J.

WANTED—Growler for testing armatures of motors up to 1/2hp. Please state price and condition. Matthew J. Berziak, 135 Playter St., Buffalo 12, N. Y.

FOR SALE—Stock of cycle and radio shop including bicycles, radios, test equip., etc. Send for complete list. Rome's Cycle and Radio Shop, 35 Brookline Ave., Springfield, Mass.

POSITION WANTED—Holder of 1st class radio telephone operator's license, graduate of radio-television school, 4 years servicing experience, 5 years radio-operator, mechanic Army experience. Anywhere in U.S. Stephen F. Sosh, 249 W. Second St., Mt. Carmel, Pa.

SWAP—Brand new .45 cal. Colt automatic; Voightlander camera, 2 1/4 x 2 1/4 with f3.5 lens; Zeiss enlarger, 35mm, prints 2 1/4 x 3 1/4, German 15 jewel watches. Want combination tube tester and multimeter, or what have you? Denaro's Radio Repair, 8148 - 102 Ave., Ozone Park 17, N. Y.

FOR SALE—Keystone 16mm 750 watt projector; 1 camera tripod; 2 rolls of films; 16mm camera, f3.5 lens; splicer outfit; large 5' screen; camera case; used very little, \$220, or what have you? E. L. Hahn, 524 Napoleon St., Johnstown, Pa.

FOR SALE—Transvision 7" TV with FM sound, operating condition, \$160; Weston 564 volt ohmmeter, new, with leather carrying case, \$20. E. V. Murphy, 331 Edmonds Ave., Drexel Hill, Pa.

FOR SALE—Hallicrafters TV set, T 54, like new, used few months, with adjustable magnifying lens, \$179, without lens, \$169. Will guarantee that the set is in good condition. Eugene Connor, 1575 Broadway, Buffalo 12, N. Y.

WANTED—Instruction book for BC-348-R as well as some original parts as well as 6E5, 6K7, 6C5, 6J7 valves. Have for sale or swap German diagrams, valves. Gerhard Kensy, 20a Alvern, Soltau, Germany.

FOR SALE—Have stock of receiver, transmitter and cathode-ray tubes in excess of our needs. Any company that would be interested kindly write to V. Ronald Nelson, Augustana College, Sioux Falls, South Dakota.

FOR SALE—Triplett VOM, model 666H, like new, \$15. H. A. Messmer, 141 E. 332 St., Willoughby, Ohio.

SELL OR TRADE—One GE 0-1000 dc amperes 8"; one 0-100 Weston dc amperes 8"; one Weston 0-400 dc amperes 8"; one Norton 0-300 ammeter 8"; good condition. Want disc or wire recording units, less amplifier. Bro. Augustine, St. Meinrad's Abby St. Meinrad, Ind.

FOR SALE—3 2½" dia. panel mounting 0-250V ac and dc voltmeters, \$2.25 each; 1 2½" dia. panel mounting 0-6 dc ammeter, \$2; 1 3" dia. extended panel type mounting 0-0.6 ac-dc ammeter, \$3.50. All are German meters. Albert P. Hart, 4848 Linden Ave., Hammond, Ind.

WANTED—General Radio capacity bridge in good condition. Bob Goodall, Ogallala, Nebraska.

SELL OR TRADE—Western Electric vacuum tube hearing aid, like new and in perfect condition, cost \$175, sell complete for \$35 or trade for good camera. E. J. Fanley, 150 E. State St., Columbus 15, Ohio.

SELL OR TRADE—New cast and sealed scope transformer, 110V 60 cy primary, sec., 1750V at 4ma., and matching fil. trans. 6.3V at .8A, 2.5V at 1.75A, \$8. Bob Atkeisson, RFD No. 9, Kansas City 3, Missouri.

SELL OR TRADE—HQ 129X with speaker, \$130; Triplett 625NA, \$30; GI 2 speed recorder and play back unit, \$15; Robot camera, f2.8 and f3.8 Tel-Xenar lens, \$110; and other radio parts. Send for list. Pat Esposito, 1720 - 57th St., Brooklyn, N. Y.

FOR SALE—10 used good BC464 Target rec. and selector units, prepaid \$7.50 each. Also one BC 1335, new less covers, prepaid \$50. Or swap for a LM or BC 221 freq. meter, must be good with chart and Xial. Fred Bauer, Box 2112, Daytona Beach, Florida.

FOR SALE—Three months use. Precision 954-G multi-range meter and tube tester, \$82; Precision EV-10 VTVM with RF probe, \$75; Precision E-200 sig. gen., \$44.50; Sparx sig. tracer, \$36; C-D capacitor bridge, \$14.50; Speco capacitance and resistance decade, \$15. All for \$250. Jack Newland, 1503 - 16th St., Bedford, Indiana.

FOR SALE—Precision series 844P multi-tester, like new, \$24.50 FOB. John Gort, Rock Valley, Iowa.

FOR SALE—Books: Nilson and Horning Radio Operating Questions and Answers, \$2.50; Eastman Fundamentals of Vacuum Tubes, \$3; Everitt Communication Engineering, \$4; Morecroft Principles of Radio Communication, \$2. 20% deposit balance COD. Leon Medler 2109 Daly Ave., Bronx 60, N. Y.

FOR SALE—7.65 cal. J. P. Sauer & Sohn revolver, automatic with 65 shells, \$40. Highly nicked and in excellent condition. Also UNIS cal. 6.35 automatic PISTOLET, will fit in palm of hand, \$25. Or will trade either for radios or tubes. Goodwin Radio Shop, Rankin, Ill.

FOR SALE—Converted 110V ac, BC 412 A oscilloscope, complete, \$50; Weston 665, volt-ohm-milliammeter, 0-1000V ac or dc, 0-10 megohm, 0-1000 milliamperes dc, brand new, \$35.50; BC 645, 15 tube transmitter, receiver with dynamotor and remote control head, brand new, \$16.50. Norman Stahl, 21 East 43 St., Brooklyn 3, N. Y.

BUY OR SWAP—Solar CF-1-60 condenser tester. Sell or swap one Philco station setter, also new oxy-acet. welding outfit, one Hickok 203 tester, and two letter size duplicating machines. John Sporna, Escatawpa, Alabama.

FOR SALE—Rider Chanalyst, 162", good condition with cables, \$100. Consider good PA system, or what have you? Cleo J. Cathey, Box 953, Seagraves, Texas.

FOR SALE—Schematic diagrams for small 3 tube portable receiver, 100-20,000kc, tunes airport frequencies, harbor patrol, etc., \$2 each, cash or money order. Also Astatic JT30 crystal mike, complete with desk stand, new, \$12. Ship COD. William T. Neat, Box 26, Winchester, Ill.

SELL OR TRADE—Audar two speed recorder and playback, portable type; Ulustravox 35mm sound slide projector; 2½" x 3½" German camera, f3.5 lens. Want television sets, photographic equip. or what have you? C. M. Buttiger, 8925 Prest Ave., Detroit 28, Mich.

FOR SALE—"R-niner" with TV coils for bands 2, 4 and 5. Originally cost \$40, will sell for \$28 complete. William M. Carroll, 710 Valley St., Maplewood, N. J.

FOR SALE—R.C.P. model 805 combination tube checker and volt ohm milliammeter, \$90; BC-348-Q receiver converted to 110V ac, with added noise limiter, \$60. Thomas Steele, 500 South Wayne, Angola, Indiana.

WANTED—Storage battery in good condition, auto type, 6V, highest capacity possible. Can also use E.C.O. and N.B.F.M. units. Will trade H.F. microphones and pickups, transmitting tubes, portable rcvr, or Jensen A-12 concert speaker, or other items. Paul H. Prokes, 9216 S. Menard Ave., Oak Lawn, Ill.

SALE OR TRADE—One Abbott TR4 and one TR4B transceivers with mikes and power supply, also one Sperti Handie-Talkie; all 2 M 144-148 MC. Want a 16mm camera and projector. John Mc. Brown, 5848 Rollins Ave., Washington 20, D. C.

FOR SALE—Radio receiver BC348Q, converted for 115V ac, additional stage of audio, separate R.F. and audio gain cont., standby, B.F.O. and A.V.C. switches wired for "S" meter, jacks for phones and speaker, \$70. A. P. Case, 3633 West 104th St., Inglewood, Calif.

WANTED—Name and address of person or company who can make small bakelite or aluminum nameplates. Theodore W. Ferus, 48 Hawthorne St., Lowell, Massachusetts.

SWAP—Xmitter (part of SCR 522) dynamotor, 28V 7½ amperes xformer, 0-3ma meter and 8007.69 xtal. For rec. covering 155mc. W. Lang, 5 Frisbie Ave., Albany 2, N. Y.

FOR SALE OR TRADE—RME-45 receiver and speaker, \$100; Hallicrafters S20R, \$40; Meissner 150B transmitter, complete, \$175. Want Temco or Collins transmitter. Marvin Shellhamer, 224 Pitt St., Tamaqua, Pa.

WANTED—30 to 40mc AM mobile receivers, particularly Motorola P-69-17A. Also would consider transmitting equip. in same range. Advise makes, model and condition. Irons Service Co., 2532 Wayside, Fort Worth, Texas.

FOR SALE—Hallicrafter radio SX 25 with matching speaker, late model, excellent condition. Best offer. H. A. Keever, 129 West Silver St., Lebanon, Ohio.

FOR SALE—Sam's Photo Facts, 1 to 8, perfect condition, never used, \$1 per set. Also Superior sig. gen., model 600, new, cost \$52.50, sell for \$40. Fred M. Merrill, Callicoon, N. Y.

FOR SALE—Complete 1947 DeForest's training course in Radio and Communications, \$15; I.C.S. course in Radio Servicing, \$12; Riders' Manual vol. 14, perfect, \$13.50. Juhas Jr. Radio Service, MTO 12, Homeyer Rd., North Tonawanda, N. Y.

FOR SALE OR TRADE—Three 110V dc motors; one 1/40 hp series wound; one 1/30 hp shunt wound; and one 1/20 hp compound wound. Also a "Sun-Kraft" ultra-violet ray lamp in leatherette carrying case. Cash or make an offer. Troy S. Starr, 29 Rosedale Drive, Binghamton, N. Y.

WANTED—Jewell 3" milliammeter, 0 to 500 range or higher. M. H. Nelson, 301 Oak Knolls Ave., Rockford, Ill.

SALE OR TRADE—Two portable meters, G.E., new, ½ of 1% accuracy, mirror scales, knife edge pointer, 0 to 3 and 150V dc-600V ac. Need audio oscillator 5" scope. Best offer accepted. George Coutts, 58 Hilltop Rd., Levittown, N. Y.

FOR SALE—50 radio chassis, dating back to 1929, some with cabinets. Will sell complete chassis or any parts from chassis, let me know your needs. Want Riders' Volumes 3, 4 and 5; state condition and price. Joe Holt Radio Service, Box 293, Clinton, Ark.

FOR SALE—250W phone-CW transmitter. Cabinet 1; 6V6-807-PP 5514's, individual meters, coils 80, 40, 20, 10. Cabinet 2; Collins speech clipping amplifier to PP 809's, 800V dc-250ma power supply. Cabinet 3; dual power supply, 1100V dc-250ma, 400V dc-300ma. \$250. William T. Burrell, 2945 Amherst St., Norfolk 2, Va.

FOR SALE OR TRADE—Revere model 70, 8mm magazine, movie camera outfit, complete, with f2.8 B&L coated lens, case, and filters. Used three months, like new, \$100. Film available. Jack Heller, 2643 N. Washtenaw Avenue, Chicago 47, Ill.

FOR SALE—Two complete surplus TBY transceiver units, excellent condition, with shipping cases, \$20 each, or both for \$35 FOB. Also one LM freq. standard, complete, ac power supply, calibration book, \$55 FOB. Raymond H. Ives, Route 2, Lake Terrace, Norfolk, Va.



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